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Citrus Insect Control For January, 1956

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VOL. 37 — NO. 1 JANUARY, 1956 BARTOW, FLORIDA

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R. M. Pratt

# Citrus Insect Control

R. B. Johnson

## For January 1956

W. L. THOMPSON,
R. M. PRATT
R. B. JOHNSON*
Florida Citrus Experiment Station, Lake Alfred

W. L. Thompson

Purple scale infestations were at a comparatively low level in December and will remain low through January, although there will be an increasing trend in activity.

Red scale activity was at a moderately high level in December, and there was a hatch of short duration. Populations declined sharply from the high levels of October and November and will be low in January.

Purple mite populations were at an average level for December. Present indications are that December will be warm and purple mite will not be a particularly severe problem in the winter and spring. If the weather continues to be dry, there will be more damage than if rains are more abundant. Six-spotted mite is not expected to be a problem, although there will be some increase in April and May. Mealybugs will not be a general problem.

Rust mite activity is fairly high and will remain at a high level through January.

### SPRAY PROGRAM

Red scale infestations are about average for this time of the year, and some groves have medium to heavy scale infestations but the general level is low. Where either red or purple scale infestations are high, a scalicide should be applied before the spring flush of growth. If red scale is present on fruit or leaves when the new growth comes out, the crawlers will settle on the very young leaves and distort them before it is time or safe to apply the post-bloom spray. Purple scale will cause fruit drop and if dry weather continues, the combination of purple scale and dry weather is likely to cause very heavy drop.

In the Indian River area from Sebastian southward, dormant scalicides have been very effective for the control of purple scale and may be used in preference to a summer application. If a scalicide is applied, either parathion or malathion should be used in preference to oil. Neutral compounds of zinc, copper, and manganese, and wettable sulfur, as well as the miticides, can be combined with parathion or malathion.

Although mealybugs may not be serious in most groves next spring, there are some groves where these insects have been observed on fruit and tree trunks. A pre-growth spray of parathion has been the most satisfactory application for mealybug control. If mealybugs are controlled before the fruit has set, there will be no problem of them settling under the button of young fruit where they are difficult to kill.

If any six-spotted mites are observed on mature leaves and lemon sprouts, the grove should be sprayed before new growth starts. Six-spotted mites are less of a problem in the spring where a dormant miticide has been applied unless reinfestation develops from adjacent infested groves.

Purple mite infestations are about average for this time of the year and severe leaf drop and "firing" is likely to occur if mites are not controlled during cool dry weather. Early fall sprays should not be expected to control the mites until the post-bloom period so inspections for purple mites should be made in January to determine whether a pre-growth miticide application should be made.

Rust mite infestations have been fairly heavy. Rust mites can be a factor in causing leaf drop so young trees and trees where the crop has been picked should be sprayed as well as those where the crop has not been picked. Even crops to be processed should not be neglected because fruit that is severely damaged by rust mites becomes soft in dry weather and is not suitable for processing or for the fresh fruit market.

January is an opportune time to apply nutritional sprays but they can also be applied during the post-bloom period. However if a copper-oil is to be used post-bloom it is important to apply a dormant zinc because it is not advisable to combine both zinc and copper with oil.

Scab control on Temples and grapefruit in the coastal areas is most satisfactory where the copper spray is applied before any new growth comes out.

**Scale Control:** Parathion at 1 to 1.7 pounds or malathion at 3 to 5 pounds, or the equivalent of either material in other forms, per 100 gallons are the preferred scalicides during January. Sulfur, miticides, and nutritional elements can be combined with parathion and malathion. Lime-sulfur can also be used with parathion. Oil emulsion should not be used in the dormant spray because of the danger of injury if cold weather occurs. Due to the subnormal amount of rain in 1955, the soil is very dry and there is danger of leaf drop if oil is applied even though no freezing weather occurs. Oil sprays will also retard degreening of Valencias in the spring.

**Mealybug Control:** A thorough application of 1.7 pounds of parathion per 100 gallons has been very effective.

**Mite Control:** Purple mite control can be obtained with several materials. DN Dry Mix is used at 0.66 pound per 100 gallons. It should not be used in highly alkaline solutions nor should it be used on succulent foliage. Ovotran at 1 pound per 100 gallons is effective and especially recommended where mite eggs are numerous, but it does not kill active mites. A combination of ovotran plus ½ pound of parathion per 100 gallons is effective where both mites and eggs are abundant. Ovotran can also be combined with lime-sulfur. Aramite at 2 pounds per 100 gallons is one of the safest miticides on succulent foliage, but not very effective where purple mite eggs are numerous. EPN at 1 pound per 100 gallons is also effective and can be used at any time, but it requires the same safe

(Continued on page 19)

* Written December 22, 1955. Reports of surveys by Harold Holtsberg, Cocoa; J. W. Davis, Tavares; K. G. Townsend, Tampa; T. B. Hallam, Avon Park; and L. M. Sutton, Lake Alfred.

144578

# Puerto Ricans Concerned About Burrowing Nematodes

LAKE ALFRED, Dec. 22 — Three Puerto Rican officials, very much concerned about the threat of the burrowing nematode, fired a barrage of questions at citrus scientists during a visit here this week.

The stop-over in Florida was promoted by findings gleaned during hearings which the trio attended in California regarding proposed quarantine against nursery stock from this state and Puerto Rico.

The visitors were Luis R. Cotoni, director of quarantine service; Dr. George Wolcott, entomologist, and Charles F. Pennock, a leading nurseryman.

Pennock said one reason for the stop was to gain an idea about the operation of the State Plant Board of Florida. No such organization exists in Puerto Rico and the three men were outspoken in their opinions that a similar body is neeeded.

"As far as I know, there is no instance of burrowing nematode in Puerto Rico," Penock explained. "But there is no assurance that we are immune; that the nematode will not invade the island and cause as much damage as it apparently has to citrus Florida. That is why we need some organization like the Plant Board, to keep us free of such diseases."

Pennock pointed out that a visitation of the burrowing nematode would mean definite quarantine by California and loss of a big customer for Pureto Rican nursery stock.

The visitors compared notes with scientists at the Citrus Experment Station and at the State Plant Board laboratory on the qualifications of leading nematologists in this country. Pennock said that Puerto Rico officials were interested in the employment of an outstanding man in this field.

Cotoni said that efforts would be made to contact a well known nematologist who might be willing to remain on the island two or three years to train others in the work.

"We are not overlooking suggestions that a young man be hired," he stated. "But it is felt that an established nematologist can do much to teach and train young Puerta Rican scientists already interested in the work."

The visitors expressed interest in experiments being conducted by state and federal research men and said they were amazed at the knowledge these men have on the nematode.

## CENTRAL STATION IS CLEARING SHIPMENTS OF CITRUS TO WEST

Fumigating and certifying citrus fruit cleared for truck shipment to California and Arizona from Florida now is accomplished by the Plant Board at a central station at Minneola.

Since Oct. 31 this system has been in effect. It replaces the former system under which State Plant Board inspectors were charged with checking each truckload of fruit destined for these Western areas.

The new station handles the certification of all citrus with the exception of the state's lime crop and fruit loaded for shipment at Florida west coast packing houses. Plant Board inspectors will continue to check these shipments.

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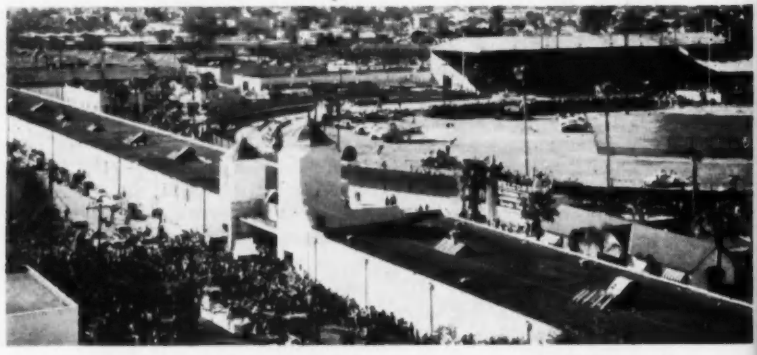

SPECIAL AGRICULTURAL EVENTS

Beginning with the West Coast Dairy Show on January 28, each day of the Fair will feature a variety of events of special interest to farmers, growers, livestock raisers, dairymen, poultrymen and nurserymen . . . State and County Exhibits . . . Dairy and Beef Cattle Shows and Sales . . . Barrow, Poultry, Swine and Rabbit Shows . . . Fat Stock Show . . . Parades of the Champions — Dairy, Beef, Barrow and Swine . . . FFA and 4-H Club activities . . . Horticultural Exhibits . . . Make your plans now to see this vast panorama of the diversified agricultural productivity and progress of The Sunshine State.

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# Progress Report On Treating Citrus Trees In Place To Control Burrowing Nematode

R. F. SUIT
AND TROY L. BROOKS
FLORIDA CITRUS EXPERIMENT STATION, LAKE ALFRED

AT MEETING FLORIDA STATE HORTICULTURAL SOCIETY

The pull-and-treat method of controlling burrowing nematode **Dadopholus similis** (Cobb) Thorne, on citrus has proved highly successful during the past five years (2). It is, however, an expensive and time consuming method since it involves the destruction of all trees in the treated area. A method of control that would not involve destruction of bearing trees would, if successful, be of great value to the citrus industry. Last year we mentioned that a search for such a treatment has been going on at the Citrus Experiment Station (1). This year, we wish to summarize results obtained so far with certain materials, including Vapam (N-869), Nemagon (OS-1897), and VC-13 Nemacide. A number of experiments are in progress to determine whether a concentration of the chemical and a method of application could be found that would not be injurious to citrus trees and would give control of the burrowing nematode.

The results with Vapam were not promising. Solutions containing from 25 to 200 p.p.m. of Vapam in water were applied April 6, 1954, at rates of 6 and 12 acre-inches to half the root area of duplicate single tree plots. Four months later, sampling at depths of two and four feet revealed no reduction in the nematode population (Table 1). One year after treatment, excessive damage to the trees was evident where the 100 to 200 p.p.m. concentrations were used even though only half the root area had been treated. No significant injury was caused by 25 p.p.m. of Vapam or by the 6-acre-inch application of 50 p.p.m. It would appear, from this preliminary experiment that, under our conditions, citrus roots are unusually sensitive to Vampam and that concentrations of Vampam that they will tolerate will not control the nematodes.

It was thought that if a strip of soil between the rows of trees were to be fumigated, roots subsequently growing into this zone of treated soil might be free of the burrowing nematode and be beneficial to the trees. To test this hypothesis, experiments with row treatments were established in two groves. Strips 16 feet wide between the rows of trees were treated. Nemagon, Dowfume W-85, D-D Soil Fumigant, N-339, DCB-40, D-D plus Nemagon, and VC-13 Nemacide were included in the tests. The first five materials were applied on April 15, 1954, and the last two on October 27, 1954. One year after treatment, samples obtained from new roots growing into the treated soil were examined. Nemagon was the only one of the five materials that gave some control of the burrowing nematode (Table 2). However, there was only 11 to 23 inches of new root growth where the Nemagon was used while at least 36 inches of growth had occurred where the other materials had been used. After 18 months, there was no control from any of the treatments. The results from the plots in the second grove are similar to those from the first grove given in Table 2. It is apparent that the burrowing nematode when present in adjacent roots and soil, will reinfest treated soil as fast as the roots grow into it.

Of the six nematocides used in the

row treatments, Nemagon and VC-13 were the only ones that have been used for treating soil around living plants and are relatively non-phytotoxic. An experiment was started to find whether these two materials might be useful for soil treatment around citrus trees in place and at what rate of application. The soil around the trees in duplicate plots of three each was treated by hand

TROY L. BROOKS

injection every square foot at a depth of 10 inches during the first week of February, 1955. VC-13 at 15, 30, and 60 gallons per acre and Nemagon at 2.5, 5, 7.5 and 10 gallons was used. Observations on the effect of the treatments on the trees were made about every two months. The percentage defoliation of trees treated with Nemagon increased as the rate of application was raised (Table 3). This defoliation is the result of root injury. There was no detrimental effect from any of the VC-13 treatments. Root samples were collected about seven months after the treatment and examined for the presence of **R. similis** (Table 3). It was not possible to obtain root samples from plots treated with Nemagon at 10, 7.5 or 5 gallons per acre, as the roots had been destroyed. **R. similis** was found in all root samples although they were not numerous in the samples from the treated plots. Since roots in three of the Nemagon plots had been killed by the treatments, a series of soil samples were examined. In general, the total nematode population was less in the treated plots than in those not treated, but it could not be said that a control had resulted. It is usually difficult to obtain **R. similis** from soil, and it was found in only three samples (Table 3). A satisfactory control of the burrowing nematode was not obtained with any of the treatments. Nemagon will cause root damage when injected into the soil during the spring at rates of five or more gallons per acre.

Additional experiments are in progress in which other methods of application for Nemagon and VC-13 are being tested. Nemagon was absorbed on Vermiculite and the material spread evenly in 20 tree plots at rates of 1, 2, and 4 gallons of toxicant per acre. The plots were thoroughly disced both ways before and immediately after this granular material was spread on July 13, 1955. In another experiment, emulsifiable Nemagon was introduced into the suction line of the irrigation system and applied to two 2-acre plots at the rate of 2 gallons of toxicant per acre on June 14, 1955.

(Continued on page 11)

**Table 3. Results of Soil Treatment with Nemagon and VC-13 Nemacide on Citrus Trees and Nematode Population.**

| Material (1) | Gallon per acre | Percentage defoliation 4/11/55 | 6/29/55 | 9/27/55 | Average Nematode Population Root Samples 9/1/55 R. similis | Soil Samples 10/4/55 Total | Soil Samples 10/4/55 R. similis |
|---|---|---|---|---|---|---|---|
| VC-13 Nemacide | 60 | 0 | 0 | 0 | 87 | 182 | 0 |
| VC-13 Nemacide | 30 | 0 | 0 | 0 | 53 | 193 | 6 |
| VC-13 Nemacide | 15 | 0 | 0 | 0 | 14 | 175 | 3 |
| Nemagon | 10 | 6 | 64 | 82 | X(2) | 49 | 0 |
| Nemagon | 7.5 | 6 | 46 | 66 | X | 196 | 0 |
| Nemagon | 5 | 2 | 28 | 50 | X | 137 | 0 |
| Nemagon | 2.5 | 0 | 8 | 12 | 13 | 170 | 0 |
| Non-treated | — | 0 | 0 | 0 | 189 | 259 | 7 |

(1) Treatments applied February 1 — 4, 1955.
(2) X = roots killed by treatment — none available for sampling.

**Table 4. Effect of Methods of Application on Control of Nematodes by Nemagon and VC-13 Nemacide.**

| Material | Method of Application | Gallons per acre | Average number Nematodes per root sample(5) Total Nematodes | R. similis |
|---|---|---|---|---|
| Nemagon | Granular(1) | 2 | 150 | 28 |
| Nemagon | Granular(1) | 1 | 101 | 21 |
| Nemagon | Granular(1) | 1 | 94 | 7 |
| Nemagon | Granular(1) | 4 | 28 | 3 |
| None | | — | 94 | 28 |
| Nemagon | Irrigation(2) | 2 | 136 | 45 |
| None | | — | 290 | 91 |
| Nemagon | Irrigation(2) | 2 | 168 | 70 |
| None | | — | 238 | 84 |
| VC-13 Nemacide | Drench(3) | 30 | 108 | 24 |
| None | | — | 206 | 80 |
| VC-13 Nemacide | Irrigation(4) | 15 | 252 | 73 |
| None | | — | 479 | 102 |

(1) Applied July 13, 1955.
(2) Applied June 14, 1955.
(3) Applied April 22 and May 25, 1955.
(4) Applied July 1, 1955.
(5) Root samples obtained September 21, 1955.

**Table 1. Effect of Soil Drench with Vapam on Nematode Population and Tree Conditon**

| Plot* | Concentration of Vapam | Amount of solution Applied Acre inches. | Total Nematodes per Sample 8/19/54 2 ft. Depth | 4 ft. Depth | Condition of trees |
|---|---|---|---|---|---|
| 1 | 25 p.p.m. | 12 | 39 | 42 | 90 |
| 2 | 25 p.p.m. | 6 | 182 | 126 | 90 |
| 3 | 50 p.p.m. | 12 | 252 | 147 | 50 |
| 4 | 50 p.p.m. | 6 | 49 | 207 | 100 |
| 5 | 100 p.p.m. | 12 | 126 | 98 | 25 |
| 6 | 100 p.p.m. | 6 | 203 | 126 | 40 |
| 7 | 200 p.p.m. | 12 | 119 | 21 | Dead |
| 8 | 200 p.p.m. | 6 | 178 | 66 | 10 |
| 9 | None | — | 283 | 119 | 100 |
| 10 | None | — | 91 | 196 | 100 |

* Treatments applied April 6, 1954.

**Table 2. Effect of Row Treatment on the Control of the Burrowing Nematode**

| Plot (1) | Material | Gallons per Acre | Average number R. similis per sample (2) 4/26/55 | 10/7/55 |
|---|---|---|---|---|
| 1 | Non-treated | — | 33 | 143 |
| 2 | Nemagon | 10 | 1 | 108 |
| 3 | Dowfume W-85 | 25 | 37 | 802 |
| 4 | D-D | 100 | 35 | 973 |
| 5 | N-339 | 60 | 44 | 141 |
| 6 | DCB-40 | 60 | 34 | 175 |
| 7 | D-D + Nemagon | 90 + 10 | — | 22 |
| 8 | VC-13 | 30 | — | 63 |

1. Plots 2 through 6 treated April 15, 1954.
   Plots 7 and 8 treated October 27, 1954.
2. All samples obtained from new roots growing back into treated soil.

# Crude Hesperidin Purification

R. HENDRICKSON

FLORIDA CITRUS EXPERIMENT STATION, LAKE ALFRED

J. W. KESTERSON

Hesperidin, the principal glucoside of oranges and predominant constituent of such products as "citrin," citrus Vitamin P and citrus bioflavanoids, continues to find extensive use as a therapeutic agent. It is administered in the treatment of abnormal capillary fragility and permeability associated with hemmorragic disorders. The growing interest in hesperidin has pointed to the need for additional information on the recovery and purification of this by-product. A previous report (2) evaluated the conditions and procedures necessary for maximum recovery of crude hesperidin and it is the purpose of this report to discuss the methods of purifying crude hesperidin.

The essential features of the perviously reported recovery procedure (2) were an alkaline extraction of chopped orange peel followed by neutralization, and the addition of filtercel and heat to promote crystallization and aid filtration. The crude hesperidin subsequently isolated and dried, was found to vary in hesperidin content from a high of 42 percent to a low of 25 percent, depending on the time of the year and the variety extracted. The investigation of methods of purifying crude hesperidin was carried out with a composite example of the following composition: 30 percent hesperidin, 40 percent filter-cel, and 30 percent ballast impurities.

Presented before the Sixty-eighth Annual meeting of the Florida State Horticultural Society.

### Extraction Technique For Purification

The general extraction technique was confined initially to using a minimum ratio of 25 grams of crude hesepridin per 500 ml. of alkaline solution or solvent. After stirring 15 to 60 minutes, the sample was filtered, neutralized (diluted in the case of some solvent) and allowed to crystallize for 24, 48, or 72 hours. The sample was then filtered, dried, and analyzed for yield and purity. Hesperidin recovery in the latter part of the investigation was improved by slurrying the crude with only 350 ml. of solvent and using the other 150 ml. to either reslurry or wash the remaining insolubles.

Initial experience indicated that an economical commercial purification of crude hesperidin would be dependent on an alkaline extraction followed by filtration and neutralization. Calcium and magnesium hydroxides were found to have an inadequate hesperidin solubility for a concentrated extraction. Dilute ammonium hydroxide and sodium carbonate solutions did not show adequate solubility for hesperidin even at evaluated temperatures. It was soon evident that a strong alkali such as sodium hydroxide would be required.

When an O.2N sodium hydroxide solution was used a very satisfactory extraction of hesperidin was obtained, but the subsequent filtration from the insoluble and inert material proved exceedingly slow. Further investigation led to the addition of isopropyl alcohol to the extracting solution as a means of increasing the filtration rate.

### Effect of Alcohol on Filtration Rate

Varying quantities of isopropyl alcohol were used to replace the water of a O.2N sodium hydroxide solution and the rate of filtration measured against concentration of alcohol. As can be seen in Fig. 1, the rate of filtration proportionately increased with the alcoholic content. The improvement is brought about by the greater degree of dehydration and coagulation of high molecular weight colloidal impurities. The filtration was sufficiently improved with 40 to 50 percent alcohol to warrant commercial consideration. It was necessary, however, to evaluate the effect of alcoholic content on hesperidin recovery.

### Effect of Alcohol on Hesperidin Recovery

Shown in Fig. 2 is the effect of alcohol concentration upon the recovery of hesperidin from the crude product. There was a noticeable decrease in

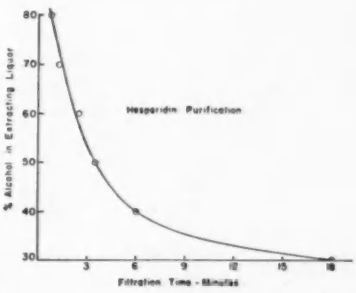
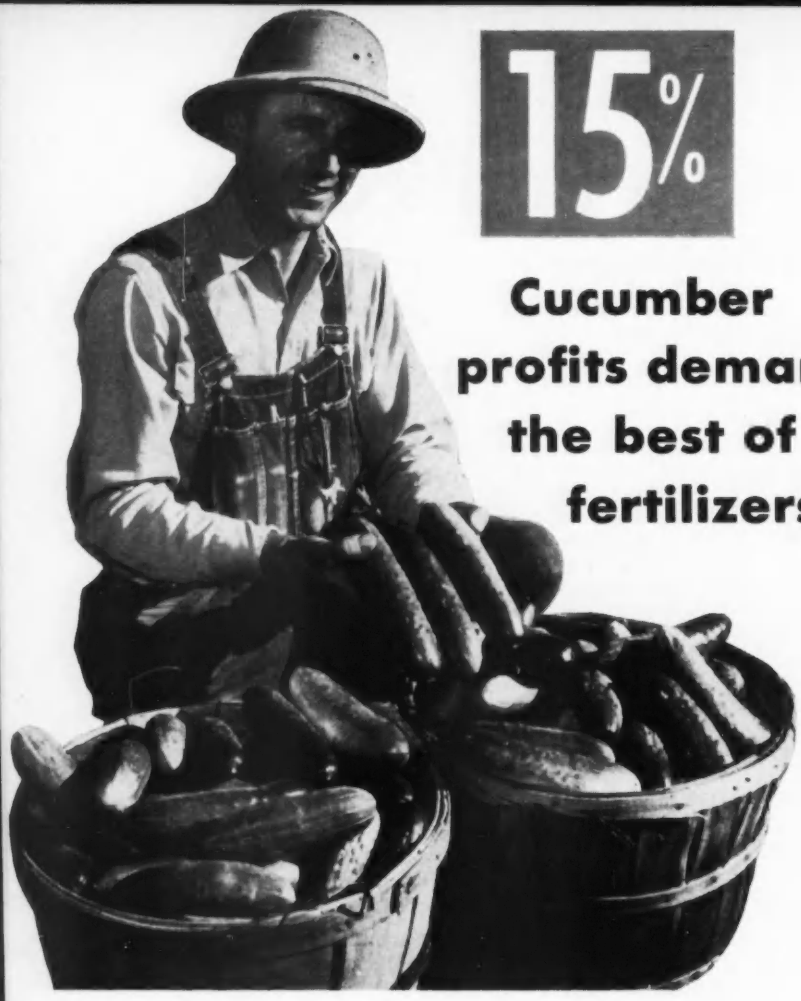



**Fig. 1.**
Effect of isopropyl alcohol upon rate of filtration of extracting liquor.

yield as the concentration of alcohol increased, while the purity of the isolated samples was rather constant at 90 to 91 percent. It was also noticeable that as the alcohol concentration increased the hesperidin tended to recrystallize faster, and be considerably more voluminous and yellower in appearance. Microscopic examination brought out that the higher concentrations of alcohol increased the size and degree of needle-like



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crystal formation. The lower recovery of hesperidin at higher concentrations of alcohol was shown to be partly caused by the inhibition of alcohol upon the alkaline extraction. For example, when a 0.2N sodium hydroxide solution of 99 percent isopropyl alcohol was used, practically no hesperidin dissolved; with 80 percent alcohol, 85 per cent of the hesperidin dissolved, while at 70 percent and below, hesperidin solubility no longer became an important factor. It then became necessary to find the other factors responsible for hesperidin yield losses at lower alcohol concentrations.

### Effect of Alcohol on Hesperidin Losses

Shown in Fig. 3 is the effect of both holding time and percent alcohol in extracting liquor upon the quantity of hesperidin-like material remaining in solution. The extent of yield loss brought about by increasing the concentration of alcohol is readily seen. This is partly explained by the slightly increased solubility of hesperidin in alcohol as against water, and by the

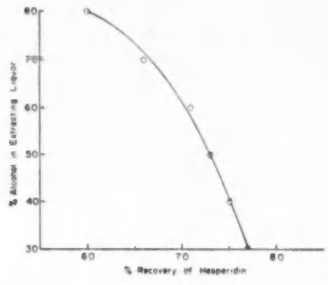


**Fig. 2.**

Effect of isopropyl alcohol concentration upon the recovery of hesperidin from crude product.

more voluminous character and crystal formation of hesperidin in the higher alcoholic concentrations. The yield of recoverable hesperidin was improved about 5 percent by allowing the samples to crystallize for longer periods of time. It is quite possible, however, that 72 hours of holding time prior to filtration would be impractical from a commercial viewpoint. Several alternatives for improving rate of crystallization can be used; the extract can be seeded with hesperidin crystals, stirred during crystallization, or the pH critically adjusted. However, it should be noted that most of these conditions which encourage quick crystallization, encourage a voluminous precipitate to form. This occludes or absorbs more

impurities resulting in lower yield and in a product of lower purity.

### Effect of pH Upon Hesperidin Recovery

The pH of the isolation solution was found to influence the crystallization

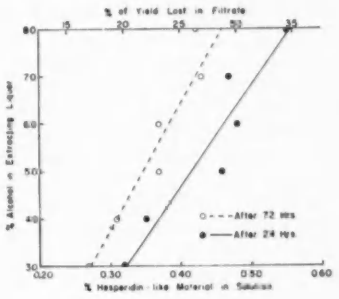


**Fig. 3.**

Effect of holding time and percent of alcohol upon the recovery of hesperidin from crude product.

and solubility of hesperidin when crude hesperidin was extracted with a O.2N sodium hydroxide solution containing 50 percent isopropyl alcohol. Figure 4 shows the quantity of hesperidin remaining in solution after 24 and 48 hours when the extract was divided and acidified to different extents. Minimum solubility was obtained on the alkaline side at a pH of 8.5 to 9.0, and an additional 24 hours of crystallization decreased the hesperidin solubility 0.1 percent, improving yield 6 percent. Speediest crystallization occurred at the lower pH. Even at the optimum pH, excessive hesperidin loss in the filtrate led to consideration of recycling as a means of decreasing filtrate losses.

### Recycling Extraction Liquor

When the neutralized alcoholic filtrate which was presaturated with hesperidin was recycled with additional alkali to become the solvent for the subsequent run, exceptionally good results were obtained. With O.2N sodium hydroxide containing 50 percent isopropyl alcohol, the hesperidin recovery was found to increase from 73 to 93 percent, while product purity increased from 90 to 95 percent. The filtration time for the extraction appeared to improve slightly. The recycling operation was completed a third time with almost as good results, yield was still 90 percent with no change in product purity. Small quantities of alcohol and a slight excess of alkali were added to fortify the recycling alcholic filtrate. The recycling can be continued several more times or the filtrate can be distilled to recover the isopropyl alcohol, which distills as an azeotrope at


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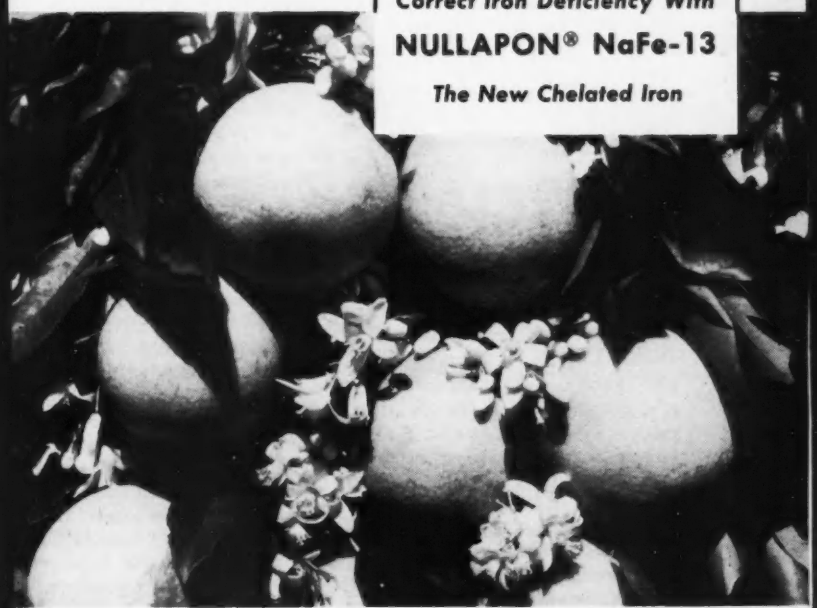

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80.3°C. containing 12.6 percent water (1).

### High Purity Hesperidin

The hesperidin obtained by the described process will vary from 89 to 95 percent purity. The final product can be improved to 99.5 percent purity by boiling the hesperidin with 8 or 9 volumes of water for 1 hour. The hot concentrated slurry is filtered and dried with less than 2 percent hesperidin being lost. Highest purity hesperidin is made by recrystallizing it twice from dimethyl formamide in a procedure similar to that of Pritchett (3).

### Other Critical Factors

Experience established that alkaline extracts of crude hesperidin were subject to degradation by long holding time or by heating prior to neutralizing. It was shown that the alcoholic alkaline extraction was inhibited at temperatures below 15°C. After neutralization, it was noted that crystallization was inhibited by low temperatures and accelerated at high temperatures. Rate of crystallization

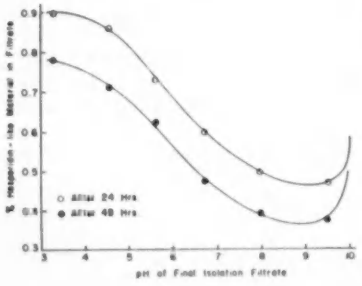


**Fig. 4.**

Influence of final pH on hesperidin solubility in alcoholic extracts of crude hesperidin.

was found to effect crystal size and product purity. Investigation of other process variables indicated O.2N sodium hydroxide to be most satisfactory and one-half hour sufficient extraction time. The ispropyl alcohol content of the extracting solution was established at 50 percent, a compromise between percent necessary for a speedy filtration versus that required for maximum yield. Optimum proportion of crude hesperidin to extracting solvent was between 25 to 45 grams of crude 500 ml. of alcoholic solvent, or so adjusted as to give a 2.0 to 2.4 percent hesperidin solution. Higher ratios considerably decrease the speed of the filtration following extraction.

### Summary

Commercial purification of crude hesperidin was shown to be possible by the following method:

Sufficient crude hesperidin is slurried for one-half hour with O.2N sodium hydroxide containing 50 percent isopropyl alcohol, to yield a 2.0 to 2.4 percent hesperidin solution. The dissolved hesperidin is filtered from the insolubles, acidified to pH 8.5 and allowed to slowly crystallize for 48 or more hours. The partially purified hesperidin precipitate is separated out for further purification. The filtrate is retained and after being fortified with alkali and alcohol becomes the extraction solution for the next batch. Further purification of the hesperidin is accomplished by slurrying the crystalline precipitate for one hour with eight volumes of water at 100°C. After filtering off the water, which contains the dissolved impurities, the crystals are dried to give a final product of 99.5 percent purity.

Solvent costs were reduced and hesperidin yields were increased by recycling the extraction liquor in subsequent purifications. The effect of alcohol on yield and filtration rate, effect of pH and holding time on yield, and the effects of other critical factors were investigated for this purification process.

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# New Bait Spray Controls Fruit Fly

A research-developed bait spray that provides effective, low-cost control of all kinds of destructive fruit flies in Hawaii is now being used against the Mexican fruit fly along the California-Mexico border, the U. S. Department of Agriculture reports.

Its use in the cooperative U. S. Mexican efforts to eradicate this serious fruit pest along the border, plus its success in Hawaii, points up the potential value of bait sprays to Southern U. S. fruit producers if, in the future, they should find it necessary to fight these sub-tropical fruit flies in their own orchards, the Department says.

Discovery of the Mediterranean fruit fly in Costa Rica in the spring of 1955 — the first appearance of this pest in North America since it was eradicated from Florida in 1929-30 — and the ever-increasing volume and speed of travel between the U. S. and areas infested with these insects, emphasize to U. S. fruit growers the importance of being prepared to cope with the fruit-fly problem.

The new bait spray—which depends on protein hydrolysate for the bait and malathion or parathion, organic phosphate insecticides, for killing action — was developed by Loren F. Steiner of USDA's Agricultural Research Service. This research was carried on in cooperation with a number of agencies, including the agricultural experiment stations of Hawaii and California. K. S. Hagen of the California station made an especially important contribution through his discovery that protein hydrolysates contain essential fruit-fly nutrients, and thus have potential value as bait materials.

In extensive tests in Hawaii, the bait sprays have controlled the oriental fruit fly, the melon fly and the Mediterranean fruit fly at costs of 2 to 5 percent of the crop value. Infestations were reduced 93 to 100 percent in 13 of 21 Hawaii field tests, where a 25-percent wettable powder bait spray containing parathion and protein hydrolysate was applied biweekly at rates of 1 to 8 pounds per acre.

Similar results were obtained with malathion wettable powder, and bait sprays with this material were adopted for use in the Mexican fruit-fly eradication project and recommended to farmers in Hawaii because of lower toxicity to man and animals. Applications of parathion, the most effective fruit-fly insecticide, without protein hydrolysate at less than 10 pounds wettable powder per acre rarely provide more than 90 percent control.

Because this bait spray attracts the flies, complete coverage of all foliage on each tree is not necessary. The baits also induce a feeding response, which means less toxicant is required to kill the flies than with conventional sprays that depend upon contact and residual toxicity. The result: better control at reduced costs.

The bait spray does not effect fly parasites and pollinating bees, rarely harming them. Reduced hazards to spray operators, orchard workers, and

consumers of fresh fruits and vegetables are other important advantages of the malathion bait spray. Present tolerance levels prevent the use of sufficient parathion and most other toxicants in nonbait formulas close enough to harvest to control flies attacking ripening fruit.

The development of parathion, malathion, and other organic phosphorus insecticides by the chemical industry was a necessary prerequisite to the current interest in bait sprays. Unlike the older insecticides, such as lead arsenate, sodium fluosilicate and tartar emetic, used with sugar or molasses solutions, these new phosphorus compounds are very quick acting, particularly when ingested. Their rapid action and high toxicity increase the probablity that flies will consume a lethal dose before their appetite is satisfied.

Sugar and molasses rank as low-grade attractants for fruit flies when compared with protein hydrolysate. Their addition to insecticide sprays in field tests in Hawaii failed to improve control. Too often the sugar reduced residual toxicity by affecting the physical nature of deposits on foliage and fruit.

## PROGRESS REPORT ON TREATING TREES IN PLACE TO CONTROL BURROWING NEMATODE

(Continued from page 6)

The irrigation procedure was as follows: 10 minutes of water, followed by 15 to 20 minutes during which the required amount of material was introduced into the line, and ending with 10 minutes of water. The irrigation line was then moved to the next middle and the procedure repeated until all middles in the plot were treated. A one-acre plot was treated with VC-13 at 15 gallons per acre by the irrigation procedure on July 1, 1955. In another experiment 50 gallons of an emulsion containing sufficient VC-13 to equal a rate of 30 gallons per acre was applied as a drench to the soil around each tree in a 30-tree plot on April 22, 1955. This was followed by an application of 100 gallons of water per tree to help the VC-13 penetrate the soil. The treated area was then disced thoroughly. The treatment was repeated on May 25, 1955.

A series of root samples was obtained from the different plots and adjacent non-treated trees on September 21, 1955, and examined for nematodes (Table 4). There was some reduction in the burrowing nematode population in most of the treated plots. However, this amount of reduction was not sufficient to be considered a control. There has been no detrimental or beneficial effect to date on the growth of the trees by any of the treatments.

During the past five years a number of materials that were supposed to control spreading decline have been tested on an experimental basis. An organic product known as M-16 was applied to the soil at the rate of 25 pounds per tree in a block of 12 trees in each of four infested groves. The M-16 was worked into the soil with a Rototiller immediately after application. The first treatment was made on December 6, 1949. and the fifth on July 20, 1951. M-16 base was also used at 50 pounds per tree on a block of four trees in each of the four groves during January and July, 1951. Another product known as Neo-Vita or ISB No. 2 was applied at rates given on the label to the soil as a drench or sprayed on the trees three times at two week intervals in four experiments during 1950 and 1951. Still another product known as Tree Life, Save-A-Tree, or Gummosis K-U-R was applied to the crown roots and around the base of a number of trees in May, 1951. It was also applied to a block of trees in a number of commercial groves. During 1952 and 1953, tobacco stems were applied at intervals in a grove with spreading decline as a possible control measure. A product known as Gold Smoke was applied to the soil in a block of nine trees at the rate of 100 pounds per tree on June 30, 1953. The material was worked into the soil with a Rototiller. The trees in these various experiments were examined at intervals to determine any possible effect of the treatment. None of these five materials controlled the burrowing nematode. In some cases there were actually more burrowing nematodes where the treatment had been used.

In view of the results presented, it is doubtful that Vapam, Nemagon or VC-13 can be used successfully for treating citrus trees in place to control the burrowing nematode. Citrus roots appear to be very sensitive to injury by Vapam and a satisfactory control of nematodes did not occur at rates not injurious to the roots. Although Nemagon did give control for a year when used at a rate of 10 gallons per acre in row treatments, reinfestation occurred within 18 months. Any treatment of soil around citrus trees in place with Nemagon would need to be made at rates less than five gallons per acre to obviate possible root damage. While VC-13 was not phytotoxic, it has not given effective control of the burrowing nematode to-date. As of today, there is no known material that could be recommended for treating the soil around citrus trees in place to control the burrowing nematode.

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## FAIR BUILDING GOING UP

Another addition to the youth and livestock building is being completed at the Pinellas County Fair grounds, says County Agent J. H. Logan. The new addition will be used for agricultural exhibits until such time as additional facilities are needed for livestock. The building is 80x120 feet.

Frozen foods now account for about 5 per cent of the total sales of chain retail food stores and somewhat less for independent stores, according to USDA. Optimistic trade predictions claim that frozen food sales will reach 15 per cent of total grocery store sales within the next 10 years.

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# Immunity Of The Lychee To The Burrowing Nematode

R. F. SUIT

FLORIDA CITRUS EXPERIMENT STATION, LAKE ALFRED
AT MEETING OF FLORIDA STATE HORTICULTURAL SOCIETY

E. P. DuCHARME

The increase in prevalence of spreading decline caused by the burrowing nematode, **Radopholus similis** (Cobb) Thorne, in Florida citrus groves has led some growers to consider replanting infested areas with another tree crop. The new plantings of lychee, **Litchi chinensis** Sonn., attracted the attention of citrus growers seeking a substitute tree crop. A few growers cleared small areas of citrus affected by spreading decline and replanted with lychees. Because of this interest in replanting infested citrus land to lychees without the benefit of soil treatment, it became advisable to investigate whether or not the lychee might be a host of the burrowing nematode and to determine, if possible, whether these lychee plantings would be a source of infestation to surrounding citrus groves.

Since no information was available on the relationship of the burrowing nematode to the lychee, the investigation was condutced both in the field and in the laboratory. The field observations were made on lychee trees planted in citrus groves infested with burrowing nematodes. One of the field plantings consisted of 65 lychee trees planted in burrowing nematode infested land in 1952. The grower had removed the spreading decline affected citrus trees and replanted immediately to young air-layered Brewster variety of lychee, without fumigating to destroy nematodes. Soil and root samples were taken from this lychee planting in 1953 and root samples were examined for burrowing nematode infestation in 1954 and 1955. Additional observations were made on two lychee trees, 25 years old, growing among burrowing nematode infested citrus. These old lychee trees and adjoining citrus were examined twice for infestation by burrowing nematodes.

Experiments with lychee plants made in temperature control tanks where the soil temperature was maintained constantly at 75° to 78°F. This temperature level seems to be close to the optimum for burrowing nematode activity and at the same time favorable for root growth. Brewster variety of lychee seedling were used in one test and air-layered plants in the second. In each experiment, six lychee test plants were potted in subsoil from a spreading decline affected grove and six control plants were potted in subsoil from a healthy citrus grove. In addition, the test plants potted in infested soil were inoculated twice with burrowing nematodes from infested citrus trees. Six citrus seedlings were planted in soil from the same source used for the lychee test plants and inoculated also with burrowing nematodes. The roots of the inoculated and control plants were examined twice for infestation by the burrowing nematodes, and after one year the plants were taken up and both the soil and roots were examined again.

### Results

None of the young lychee trees planted in the citrus grove infested with burrowing nematodes showed symptoms of decline. The growth of these lychees appeared to be normal in every respect. Burrowing nematodes were never extracted either from the soil under lychee trees or from lychee roots during the three years that these trees were studied. Lateral roots from the spreading decline affected citrus trees grew across the row middles and extended beyond the lychee trees and the rootlets mingled in a common root sphere Rootlets from these zones were sorted with forceps and incubated separately. The lychee roots from the zones of mixed roots were completely free of burrowing nematodes, whereas the citrus roots were heavily infested.

The twenty-five year old lychee trees growing in the infested citrus grove had no symptoms of decline, die back or root rot. Burrowing nematodes were never extracted from the roots of these old lychee trees.

Burrowing nematodes were never recovered from the roots of the lychee test plants although the plants were potted in infested soil and inoculated repeatedly. The citrus plants kept under identical conditions became heavily infested. The experiment was repeated with identical results. Burrowing nematodes from citrus would not force-feed on lychees and the population died.

The above experiments and observations established that the lychee is immune from the nematode that causes the spreading decline disease of citrus. Burrowing nematodes not only preferred citrus to lychee roots in the field where a choice was possible, but also could not be forced to feed on lychee roots under controlled conditions where the environment was favorable for burrowing nematodes. Lychee roots apparently do not liberate a metabolite inhibiting burrowing nematodes because in dense clumps of mixed rootlets the susceptible host

rootlets became heavily infested. It seems that the lychee roots are unpalatable to burrowing nematodes. Another reason may be that the outer tissues of lychee roots are less succulent than root tissues of citrus, avocado and other host plants of the burrowing nematodes.

The lychee, because of its immunity to burrowing nematodes, should be a satisfactory yard tree for home sites. Certainly its growth and development do not seem to be hindered by the presence of burrowing nematodes. The investigation indicates that the lychee could be used as a substitute tree crop in place of citrus where land is infested with burrowing nematodes. A few such plantings exist and one grower has planted a border of lychee trees 100 feet wide on one side of the infested home site as part of a landscaping plan, and also in the hope of preventing burrowing nematodes from getting into the surrounding citrus grove. Nothing is known as yet about the effect of such biological barriers. It would be necessary to keep the cover crop down in such a barrier to prevent burrowing nematodes from crossing it on the roots of native weed hosts. The lychee, because of immunity to burrowing nematodes, would not be a reservoir of infestation and a source of infection to surrounding citrus.

## MIAMI BEACH SELECTED FOR FFV 1956 CONVENTION

Rudolph Mattson, Ft. Pierce, newly elected president of the Florida Fruit & Vegetable Association, has announced the selection of Miami Beach for the 1956 Convention of the Association and the choice of Hotel Fontainebleau as headquarters. Dates of the Convention were announced as September 27, 28 and 29.

"The Board of Directors, in accordance with the unofficial vote of those attending our last Convention, have unanimously voted to accept the invitation of the City of Miami Beach for our 1956 Convention, and have chosen the Hotel Fontainebleau as headquarters hotel.

"More than 1100 persons registered at our recent Convention held last month, which was also at the Hotel Fontainebleau, at Miami Beach," Mattson added, and said that detailed plans for the 1956 event will be announced at a later date.

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# Marketing And Handling Citrus Concentrates

HOMER E. HOOKS
MARKETING MANAGER, FLORIDA CITRUS CANNERS COOPERATIVE

Some may question the reason for including a processed citrus product in this discussion of preventing economic waste in marketing. It might appear that by its very nature, a processed product, such as frozen orange concentrate, would hardly be subject to the factors which cause so much of our perishable fruits and vegetables to be wasted before they can be marketed profitably.

However, I can assure you that we definitely face some serious and continuing problems in preventing waste in marketing concentrate, and that these problems differ from those of the perishables less in kind than in degree. This is not an intended pun, but "degree" is precisely our hardest problem — maintaining a constant temperature level of zero Fahrenheit from the moment the can is frozen at our factory until it is opened on the consumer's kitchen table.

We recognize this as a most serious problem. Every concentrator in Florida has at one time or another suffered because his juice was mishandled somewhere along the way. Usually, to give proper service to good customers, the concentrator replaces this merchandise or a good part of it — and believe me, that is expensive.

These large posters which I am showing you indicate what the Florida Citrus Commission has been doing about it. These posters are put up on warehouse walls, in the back rooms of retail stores — anywhere they may be seen by people handling frozen concentrate, cautioning them to keep this merchandise frozen. Similar advertisements have been published frequently in the grocery trade press, and we think they have done a good job in alerting all the middlemen on the absolute necessity of handling concentrate with speed and care. It only takes a few hours in the sun on the loading platform, or placement in the dry grocery section in the back room of the store, instead of in the freezer box, to ruin frozen concentrate. This work by the Commission, together with personal admonitions by all the packers in their calls on the trade, are going a long way toward solving this problem in marketing this valuable citrus product.

Frozen concentrate is our most important processed citrus product today — there is no question about that. It has been phenomenally successful, providing a market for all increases in Florida orange production in recent years, at prices better than growers have enjoyed in most years. The spectacular growth of frozen orange concentrate is perhaps the food industry's outstanding achievement of the past decade.

In 1948-49, only 14 percent of the Florida orange crop was used to make frozen concentrate. In just two years, 1950-51, this jumped to 38 percent. Last season, for the first time in history, over half the entire orange crop — 52 percent — went to make concentrate, and we expect the same thing to happen this season. There is no doubt that concentrate will take care of most crop increases in the years ahead.

Look how the production of concentrate has grown: From 10 million gallons in 1948-49 to 65 million gallons last season, and about the same estimated for this season. That's 65 million gallons of concentrate. We have to multiply that by four to get the whole juice equivalent — 260 million gallons of orange juice. That sounds like a terriffic volume of juice, until you stop to consider that it would provide less than 1.5 ounces of juice to each man, woman, and child in the United States one time during the year.

While the per capita consumption of concentrate has of course skyrocketed — from .21 pounds in 1948-49 to 13.76 pounds in 1954-55 — the overall per capita consumption of citrus has actually declined, because our citrus crops and citrus distribution have not kept up with the growth in population. So there is still a lot to do.

We are told that consumption of citrus in all forms — fresh, canned, or frozen is equal to the consumption of all other fruits and fruit juices combined, and we begin to feel satisfied with ourselves. But then we learn that we are actually selling frozen orange concentrate to less than one-third of the families in the United States; two-thirds of the families do not regularly buy this product. This is certainly no time to sit down and waste time in self-congratulation.

Our job ahead is more effective marketing of this product. Because of the rather delicate nature of frozen concentrate, we have to market it in many different ways, depending on how we can best reach individual customers. Generally speaking, about half our sales are made f. o. b. factory — direct truck or rail-car shipments from our plants to buyers in the North. The other half of our sales are so-called "ex-warehouse" sales, wherein we maintain stocks in public warehouses around the country and permit buyers to pick up concentrate as needed. This ex-warehouse business is a vital and important function because it facilitates the handling of smaller quantities of concentrate at a time. We like this because it means that buyers will be able to take better care of their stocks. We would much rather see a customer take 50 or 100 cases at a time and maintain a fast turn-over in his store cabinets than to try to handle 500 or 1,000 cases and have part of it become de-frosted.

Marketing is of course not ended at the warehouse. Store managers play a most important role, because they deal directly with the ultimate consumer. I am glad to say that probably 95 per cent of retail store managers now know the necessity for keeping frozen foods frozen. But despite this knowledge, too many are still handicapped by old-fashioned and inadequate freezer cabinet facilities. This is perhaps the greatest single bottle-neck today to increased distribution of frozen concentrates. We are selling in almost every store in America that has frozen facilities, but there are thousands without these facilities — and many thousands more which should replace or enlarge them.

It always grieves us to hear of our concentrate being abused after all the

Presented to the Eight Annual Short Course on Causes and Prevention of Economic Waste in Marketing Fruits and Vegetables, University of Florida, Gainesville, Friday, November 18, 1955.

careful handling it has had from the day it was canned. It takes about two hours for oranges to come out of the bins, be washed, graded, squeezed, the juice concentrated and put into cans at 16 degrees, then the cans sealed and frozen solid at zero degrees, put in cartons and placed in our frozen warehouse. Speed is essential. No time is wasted in this process, and temperatures are rigidly controlled.

One way we are avoiding waste in the manufacture of concentrate is by storing frozen concentrate which is unsuitable for immediate canning. We put this juice, which may be a little too tart early in the season or a little too sweet late in the season, into 55-gallon barrels and freeze them. Then we blend it back into the production line when current deliveries of oranges need juice of that quality. In this way, concentrates are now using oranges which were heretofore considered unsuitable for concentrate, and the end product is remarkably consistent throughout the packing season.

After production, the next step is transportation to the markets, and here again, we insist on rigidly controlled temperatures to eliminate losses. We use two principal modes of transportation, the refrigerated truck and refrigerated rail car. The trucks are insulated all around with six inches of insulation — usually fiberglass. They are equipped with thermostatically controlled refrigeration units which will maintain inside vehicle temperatures from 5 to 10 degrees below zero to 70 degrees above zero. We specify zero or lower for concentrate shipments. There are nine principal truck companies serving the industry now, operating a total of about 700 trailer-tractor units. During the peak shipping periods, we have some difficulty in obtaining trucks. However, movement of concentrate has become more evenly spread out over the entire year, and there is much less trouble in securing truck service than in past years.

The mechanically refrigerated rail car is our other primary mode of transportating frozen concentrate. These cars have almost completely replaced the old salt and ice-refrigerated cars, which were not at all satisfactory for concentrate. There are 1,023 mechanically refrigerated cars in service now, and an additional 959 are on order — making about 2,000 cars soon to be available. While the average pay-load capacity of trucks is about 28,500 pounds, the rail cars range from 75,000 pounds to 125,000 pounds. Naturally, there are advantages in both. Trucks are more flexible for smaller shipments, stop-offs at intermediate points, and they are usually available on shorter notice. Rail cars of course can carry much more weight, thereby reducing unit freight costs.

You may be interested in how Florida concentrators divided their shipments between rail and truck this past season. The railroads got 53.6 per cent, and the trucks got 46.4 per cent. The trucks have made tremendous strides in recent years, forcing the railroads to re-examine their freight rates. Right now, the Seaboard Air Line railroad is petitioning to reduce its rates on concentrate, which would result in substantial savings under the truck rates.

Both rail and truck are performing well for the industry. They have gone to great expense to offer us equipment which will transport our concentrate at zero degrees, which insures that the product will reach the market without any loss in quality. They are the necessary link between our Florida plants and our


ONE MORE REASON
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Unitized Controls
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Now, Speed Sprayer controls are more convenient than ever. All engine and spray cut-off controls, including engine throttle, starter switch and gauges, are combined in a single unit that mounts on the tractor fender or end of sprayer.

No wonder that Speed Sprayers are recommended by citrus experts throughout Florida—they've led the field of air delivery sprayers consistently with advances in efficiency and economy of operation that have helped growers make real profit gains. In addition to the new unitized controls, you'll want to see the self-priming pump, greater axle clearance adjustment, and improved spray delivery shields that are among the features of the new 1956 Speed Sprayers. We'll be glad to demonstrate them — write or call us today.

*Send for* **Handy Calculator** *for figuring concentrate or dilute spray solutions. Free.*

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Northern customers, and they are doing a good job.

And they, too, are looking to the future. I have already told you about the additional 959 new refrigerated rail cars on the way. They are also developing improved refrigerated cars, using new methods of refrigeration, air-circulation, and insulation. The truck lines are working on partitioned trailers, permitting different temperatures for different products within the same load. Better transportation is certainly going to be a vital part of our future.

And what of our industry itself? We are in a good position. We have just marketed the largest concentrate pack in history, together with a sizeable carryover from the previous season, and our inventory stocks today are extremely low. We are confident that frozen orange concentrate sales will continue to be good, largely because the nation's economic outlook is healthy.

Consumer income, after taxes, is running 7 per cent above the third quarter of 1954, spending is at an all-time high, and grocery store sales continue upward.

Significantly, while our population is growing, expenditures for food are going up at a faster rate. With 9 per cent more families by 1960, we may achieve a 25 per cent increase in grocery sales. We can look forward to larger size families, more older and more younger people, and more money to spend. More housewives are working than ever before, and the convenience value of processed foods is growing. This is most important to us in marketing frozen concentrate products, like orange crystals and chilled juice in cartons.

We have been impressed by the fact that, while we are selling more total volume of concentrate, we are selling to only about 31 per cent of the families in this country, which is about the same as last year. The answer is that people who buy concentrate are buying more of it. We've seen this demonstrated in our own sales of the 12-ounce can, which makes 48 ounces of whole juice. We sold twice as much of this size last year as in the previous season, but our gain in six-ounce sales was much less. We have learned from this what other grocery manufacturers found out earlier — that you can get people to consume more cereal or bread or soap or orange juice simply by offering them the "large economy size."

With families growing, we do not feel the popular six-ounce can, making 24 ounces of juice, is the ultimate answer. And we doubt that even the 12-ounce is. We believe that the concentrate industry will have to increase the degree of concentration from the present "3 plus one" (which means 3 parts water to one part concentrate) to probably "5 plus one." This would deliver to the consumer 50 per cent more whole juice in the same size can — with no increase in carton size, transportation requirements, warehouse space, or retail cabinet space. Savings in costs would be tremendous.

Research tells us the "5 plus one" would be a good product. In fact, it would be more stable than our present product and would be able to stand more abuse and not be as vulnerable to the waste resulting from mishandling which I have been talking about here today.

We think this "super-concentrate" may be the answer for increased concentrate sales. It might be wise to try the product out in Europe, where there are no fixed habits on mixing concentrate. Then, with proper build-up here, it could be introduced in this country.

We have made a good beginning in marketing and handling citrus concentrates. But we have much yet to do, and opportunities seem unlimited. We are just on the threshold of the vast potential in marketing this amazing product.

---

### AMEND CALIFORNIA-ARIZONA LEMON MARKETING PROGRAM

Amendments to the marketing agreement and order regulating the handling of California and Arizona lemons were announced recently by the U. S. Department of Agriculture. This action follows approval of the proposed amendments by producers of more than 97 percent of the lemons produced in California and Arizona during the period November 1, 1953, through October 31, 1954. Handlers of more than 98 percent of the lemons handled during the same period have signed the agreement amending the existing marketing agreement.

The principal amendments (1) include in the marketing agreement and order authority to regulate volume of lemon shipments when the season average price is above the parity price in order to avoid unreasonable fluctuations in supplies and prices; and (2) provide that in the nomination of the non-industry member and the alternate for such member to serve on the Lemon Administrative Committee only one nominee shall be submitted for each position to be filled.


EMJEO

(80/82% MAGNESIUM SULPHATE)

Many years a favorite source of soluble magnesia for Florida soils. Used extensively in fertilizer mixtures for citrus crops and vegetables. Especially useful and economical for direct application where only magnesia is required.

Florida growers now consider magnesium a primary plant food in the same category with nitrogen, phosphorus and potash.

The recommendations of the Flordia Citrus Experiment Station at Lake Alfred, published in January 1954, stress the need for large application of magnesium for Citrus in soluble form and state that it is usually applied as a Sulphate.

Ask your fertilizer manufacturer for EMJEO, long a dependable source of this key plant food.

BERKSHIRE CHEMICALS, INC.

420 Lexington Avenue New York 17, N. Y.

. Magnesium .
. For a Full Harvest .

# NOTES OF THE TRADE

### EVERETT W. LINS (Pete)

"Pete," as everyone knows him, was born Everett W. Lins, September 29th, 1900, at Port Richmond, Staten Island, New York, receiving his early education in the Public School system there. Upon graduation from Curtis High School in Staten Island, he entered Cornell University, and received his B.S. in Agriculture in 1920. During his high school and college years he supplemented his agricultural training by working on farms during Summer vacations.

Entering the employ of North American Fruit Exchange in 1920, following several positions, including office boy, he became sales manager in 1923, when the Company name was changed to Federated Fruit and Vegetable Growers. There followed several shipping assignments from Colorado to New York, and from Minnesota to Florida. In 1925, "Pete" became a permanent resident of Florida, and became sales manager of American Fruit Growers, with offices in Miami, and in 1939 became Southeastern Division Manager of that Company, with supervision of vegetables and deciduous fruit. In 1946, all Florida sales offices of the Company were centralized at Fort Pierce, at which time Mr. Lins moved there, and still resides there with his wife and family. In 1952, four divisions were merged, and he became Division Manager of the Eastern Division, in charge of all vegetables, deciduous and citrus handled by the Company from Florida through Pensylvania, west to the Mississippi.

In November, 1953, American Fruit Growers Inc., was purchased by American National Foods Inc., which has, since then, drawn together over 5000 farmers and regional cooperatives which are farmed-owned, and are currently marketing under the well known Blue Goose trademark, offering a complete sales and merchandising service built around the familiar Blue Goose brand, with "Pete" as Division Manager of the Eastern Division.

Mr. Lins is very active in civic affairs, and presently is president of the Civitian Club of Fort Pierce, as well as president of the Fort Pierce Memorial Hospital Association. He is a former vice president of the Florida Farm Bureau Federation and was the first president of the Florida Fruit and Vegetable Association.

In addition to his many activities, "Pete" is a lime and avocado grower, with groves in Dade county, finds time to tend to his flowers at home, does a little fishing, and in 1954 found time to edit, and distribute a 54-page booklet titled "Linspirations."

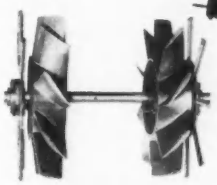
**Editor's Note:** While space does not permit printing "Pete" Lins' booklet, we are certain that readers desiring a copy can receive one free of charge by dropping a card to him at Fort Pierce.

### MAKING CRYSTALLIZED FRUIT PEEL ROSETTES

Crystallized fruit peel made from grapefruit, oranges, lemons or kumquats is especially good for gifts at any time. The peel from a grapefruit nested in citrus foliage or other greenery can be shaped into a rose for a centerpiece. Rosettes to be used as favors for individual place settings can be made from any of the smaller citrus fruits.

Select bright fruit with a thick peel and wash carefully.


**SEE This Great New Hardie HURRICANE®**



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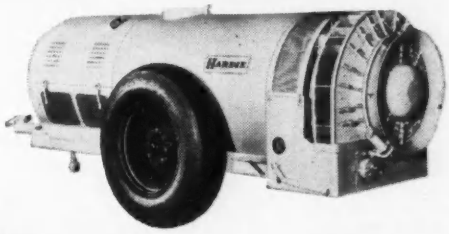
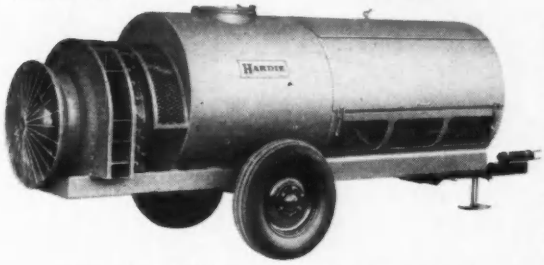
The exclusive Hardie 2-fan assembly consists of two solid, cast aluminum fans of special design, mounted with opposed blades on a single shaft and scientifically spaced. The Hurricane specially designed fan housing delivers the tremendous air volume and velocity of the two fans directly to the spray nozzles without friction loss.





*Above*—Model DF-26A, 2, 26" fans, Ford V-8 Industrial Engine, 140 HP at 2600 RPM. Model DF-26-B, 2, 26 in. fans, Ford Industrial Engine, 108 HP at 2600 RPM.

*At Left* — Model DF-24B, low priced, 2, 24 in. fans, Willys Hurricane Engine, 70 HP at 4000 RPM.

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Howe E. Moredock Co., Homestead
Howe E. Moredock Co., Miami
Indian River Farm Supply Co., Vero Beach
Minton Equipment Co., Ft. Pierce
Peninsular Equipment Co., Inc., Wauchula
Pompano Truck and Tractor Co., Pompano
Pounds Motor Co., Winter Garden
Pounds Tractor Co., Winter Haven
Quinn R. Barton Co., Jacksonville
Russell Farm Supply Store, Palmetto
South Florida Motor Co., Arcadia
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South Florida Motor Co., Fort Myers
South Florida Motor Co., Immokalee
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Take one look at a Hardie Hurricane 2-fan Sprayer in action and you know that you are witnessing performance that cannot be matched by any other equipment in the field of pest control. There is a Hardie dealer near you. Let him show you this wonderful new unit that brings new speed, efficiency and economy to citrus spraying.

**Manufactured only by**
**THE HARDIE MFG. COMPANY**
**Hudson, Michigan**

# World's Greatest Citrus Exposition

Florida's best citrus fruit in all commercial varieties will be placed on display at Winter Haven during the 1956 Florida Citrus Exposition to be held Feb. 13-18, show officials said recently.

With Florida Citrus Mutual cooperating with the Exposition, the annual "fresh fruit contest" is expected to bring out a record number of entries from all of the seven citrus commission districts, competing for cash awards, ribbons and plaques.

The climax of the contest will come with the annual "Fresh Fruit Day" to be held Thursday, Feb. 16, featuring a special program designed to attract a large crowd of growers from over the state.

Mutual has assigned Hagan Parrish of its field staff to work with the Exposition in developing the program for the contest and the special "Fresh Fruit Day."

Growers in all sections of the citrus producing belt will be contacted and urged to select their choicest oranges, tangerines, grapefruit and other commercial citrus for display during the contest. There will be awards for the best of all commercial varieties in each district, the winners going into a statewide and "sweepstake" contest.

"Our whole Florida citrus industry is based on the production of the best possible quality and this Exposition contest is aimed at encouraging growers to grow the best at all times, regardless of the ultimate use of the fruit," Jack M. Berry, Exposition president, said.

The complete details of the fresh fruit contest will be available to all growers in the state within a short time, Parish said. Participation in the contest is not restricted to Mutual members, he declared.

In the meantime arrangements for the annual contest to select the "Florida Citrus Queen" are going ahead in Winter Haven. The 1956 winner will be a busy girl during the year, it was indicated, with the Florida Citrus Commission, under special arrangements with the citrus show, having the exclusive rights to her services for personal appearances on radio, TV, at conventions, meetings and other events where there is a chance to promote Florida citrus.

# Fla. Southern Scientists Testing Hydro Bomb On Burrowing Nematodes

Scientists at Florida Southern College, Lakeland, are testing "hydrogen bombs" on the burrowing nematodes which are causing such devastation in Florida citrus groves by spreading decline.

Dr. Boris Sokoloff, director of the bio-research laboratory at Florida Southern, says that grove tests with hydrogenated fish oil will be started in an orange grove in Polk county.

### Lab Tests Good

Laboratory tests have indicated that the "hydrogen bomb," produced in a mixture of fish oil and atoms of hydrogen kills radopholus similis, the nematode which feeds on citrus roots and which produces spreading decline in citrus areas.

In the initial field testing, Dr. Sokoloff said that the soil around infected orange trees will be sprayed with the hydrogenated fish oil and then tested to determine if all nematodes have been killed. He said that the preliminary grove tests will show if a single spray is sufficient to kill the worms or if a second application will be necessary.

Because the nematode is found at varying depths in the soil, Dr. Sokoloff said that the technique which will be used in grove applications will be to follow the spraying with quantities of water so that the hydrogenated fish oil is carried deep into the ground.

### Cooperative Project

"We hope that these preliminary field tests," Dr. Sokoloff said, "will give results in the near future. The tests will be conducted in cooperation with the Soil Science Foundation (with headquarters in Lakeland) and with growers who have infested groves."

Dr. Sokoloff and other research scientists at Florida Southern reported earlier to the Florida Academy of Sciences that laboratory experiments with the hydrogenated fish oil, applied one time, resulted in the death of all nematodes. These laboratory tests also indicate that the hydrogenated fish oil will not prove harmful to citrus trees.

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Millions have taken the baths at Hot Springs—America's only health resort with natural thermal waters under the regulation of the Director of the Nat'l. Park Service, U.S. Dept. of the Interior —and, countless people have testified to the magic qualities of these world-famous baths. You, too, can find relief for jangled nerves, aching muscles, stiff joints, hardening of the arteries, and, yes, even rheumatism and arthritis.
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MAJESTIC COTTAGES
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SEE YOUR TRAVEL AGENT OR WRITE THE MAJESTIC HOTEL FOR LITERATURE

# Senator Smathers Talks On Citrus Initiative

In a talk before the Indian River Citrus Seminar recently U. S. Senator George Smathers commended the Florida citrus industry upon their initiative and commented further upon this great Florida citrus industry and evidenced by the following excerpts from his talk:

"The Florida citrus industry has carved a reputation for a fearless and independent approach to its problems. Producing two-thirds of the world's

citrus harvest, the industry has stood squarely on its own feet and sought government help only in the rare instances. It has laid before the world an example for dogged initiative and self-reliance.

### Proper Fields For Aid

"There are, however, areas where the government may properly assist the industry — notably in research against citrus diseases and in helping our Florida fruit find its markets in Europe.

"In 1955, for the first time, the Federal government appropriated $26,000 for research againsh Spreading Decline, the malady caused by the destructive burrowing nematode. The Department of Agriculture is using the money to study means of treating trees chemically. Current estimates indicate 6,000 acres are affected by the Spreading Decline.

"The government, encouraging sale of American citrus in foreign markets, is also paying 50 cents a box on overseas shipments. These payments help Florida citrus to find its place in the markets of Europe and other continents, against citrus grown near those markets in Spain, Israel and Italy.

### Future

"Boundless are the horizons for Florida citrus. Modern processing, refrigeration and marketing techniques, coupled with the resourcefulness of the industry leadership and the natural advantages of Florida, promise continued expansion for the golden harvest."

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### CITRUS INSECT CONTROL FOR JANUARY, 1956

(Continued from page 3)

handling precautions as does parathion. Aramite, EPN, and DN Dry Mix should not be used in highly alkaline solutions. It is also suggested that where parathion is being used that some other miticide other than DN Dry Mix be used because of danger of fruit burn.

Six-spotted mites can be controlled with any of the miticides used for purple mite control. Lime-sulfur at 2 gallons per 100 gallons is also fairly effective. Thorough coverage of the under surfaces of the leaves is necessary with any material for control.

Rust mite can be controlled with several forms of sulfur, but in winter, the most effective combination is 1 gallon of lime-sulfur plus 5 pounds of wettable sulfur. However, the lime-sulfur should not be used on Hamlins or Jaffas where the mature crop is still on the trees nor should it be used on tangerines. Wettable sulfur 10-100 is also effective but a more thorough application should be made in comparisan with summer spraying. Sulfur dust is the least effective, but if a thorough coverage of dust is obtained, the control should be fairly satisfactory.

When using any of the insecticides, except oil and sulfur, read the label carefully to determine whether a waiting period is required between the time the insecticide is applied and date of picking. This relates to new regulations on residue tolerances.

For more detailed information refer to the "Better Fruit Program" or consult the Citrus Experiment Station at Lake Alfred or Fort Pierce.

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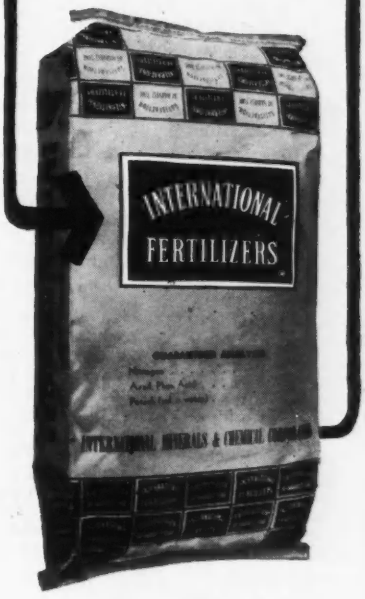
Chinese cultivated soybeans as a source of food centuries before written records were kept. The plant was first described in writing 2823 B. C.

THIS FAMOUS SIGN Says

*Satisfaction at Harvest Time*




Citrus growers know that *Satisfaction at Harvest Time* means large yields of fruit with good color, fine flavor and more solids.

That's what you can expect when you use famous quality *International Fertilizers.* They give you the correct balance of plant foods plus soluble sulfate of magnesium and trace elements needed for maximum production of quality citrus.

So see your International Fertilizer Field Representative or Dealer for prompt deliveries of the grades you need.

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# The LYONIZER

COMPILED BY THE LYONS FERTILIZER COMPANY

## Reports Of Our Field Men . . .

### SOUTH POLK, HIGHLANDS, HARDEE, DeSOTO AND SARASOTA COUNTIES

**C. R. Wingfield**

While there have been some rain that have been a great help to the moisture situation there are some sections that are still irrigating. While some have reported as much as one inch of rain it has been mostly half inch or less.

Fruit has been moving through both fresh fruit and canning channels at a rapid pace. There has been a heavy droppage of both grapefruit and oranges that will account for a large number of boxes. Lack of moisture has no doubt had its effect on Pineapple oranges maturing earlier than usual and they have hit the dirt.

The fall fertilizer application has been a long drawn out affair due to shortage of moisture and some are still waiting and are in hopes of fertilizing in January. Mites have been bad and between these and scale there has been an unusual leaf drop.

### NORTH CENTRAL FLORIDA

**V. E. Bourland**

Cool weather of the last month has aided in the maturity of the fruit which is now moving very rapidly to both the canning plants and fresh shippers. Some of the bad weather of the last week put the shippers behind in their orders and they are rushing just as fast as they can to catch up with their Christmas shipping.

All the groves in this area are looking very good and those people that have put off their fertilizing until their fruit has been picked are now seeing that their application of fertilizer is being applied.

Fruit is coloring well, lots of juice and solids are running fairly high. Some of the buyers are beginning to look around wondering where they are going to get fruit in February. Looks like when the concentrators and packers both get to going full blast fruit may turn up a little bit short.

Merry Christmas and Happy New Year to all!

### EAST HILLSBOROUGH AND PASCO COUNTIES

**E. A. McCartney**

Plenty of cold weather the past week. Fruit has colored up and looks good, some scale and a few red spider in spots. Prices are better and shippers are picking all they can ahead of the Christmas Holiday.

We are about through with our fall application of fertilizer but have been slowed down on account of rain and cold weather.

Berries are bringing a good price, other vegetables are doing fair. Some damage in low places by frost but not nearly as bad as expected. Melon growers have started fertilizing and some will have planted by the time this is published.

### HIGHLANDS AND POLK COUNTIES

**J. K. Enzor, Jr., & R. E. Lassiter, Jr.**

For the last three weeks beginning around the 20th to 25th of November we have observed fairly general amounts of leaf drop. This condition can probably be accounted for by one or more of the following conditions: Dry weather, rust mite infestation, purple mite infestation, and most probably normal leaf drop.

Purple mites have definitely not been as severe as some years in the past in the groves that we are observing. However, this does not mean that they will not cause trouble before the winter is over.

We have found some extremely heavy infestations of rust mite on leaves in the last week or so. In some cases they were apparently responsible for mesophyll collapse and the leaf drop that was occurring.

Our growers will have finished their fall application of fertilizer by the last of December and most groves are in satisfactory condition especially when one considers the low rainfall of the past four or five months. Moisture conditions are fairly satisfactory in the central and northern areas of Polk County. However, south Polk County and Highlands County are both extremely dry at this time.

We are experiencing the usual midseason fruit drop at this time and there seems to be a considerable amount of grapefruit drop also.

Even though it will be a little late by the time this is in print we would still like to take this oportunity to wish everyone A MERRY CHRISTMAS and A HAPPY NEW YEAR.

### SOUTH HILLSBOROUGH AND MANATEE COUNTIES

**J. D. Toll**

Most groves in this area are in excellent condition following the fall application of fertilizer and having sufficient moisture conditions. Fruit has colored and sized up nicely this past month and is moving steadily with oranges bringing a good price.

Melon growers were very active the last two weeks of December fertilizing and planting. There is a large acreage planted this year.

Vegetable growers have their land ready for the spring crop. In the Ruskin, Palmetto and Bradenton areas the tomato growers have already planted.

Best wishes to your and yours for a Happy and Prosperous New Year.

### WEST HILLSBOROUGH AND PINELLAS COUNTIES

**J. A. Hoffman**

The fruit market has been very good so far this season. Fruit has sized and colored up nicely. Early and mid-season oranges are getting scarce in this section, with the most of them already picked. Crops were lighter than usual for early varieties, but prices were good and most everyone appeared satisfied with the market. Midseason and Valencia oranges are loaded with a late July bloom. The regular crop in most groves is considered light.

Rust mite and red spider activity has reduced some the past few weeks but a close check should be made. Even though the fruit has been picked, rust mite should be kept under control, as they can cause severe leaf droppage.

Watermelon growers are putting fertilizer in the ground and will start planting in a few days.

ADVERTISEMENT — LYONS FERTILIZER COMPANY

## *Uncle Bill Says:*

Well Christmas is over now and we're jist startin' in on the New Year . . . so fer as we are concerned we had a better Christmas than we deserved . . . and we're plum glad we did . . . it's a mighty good feelin' to know that some folks is thinkin' kindly about us and it is sort of a relief fer us to stop figurin' out what's wrong with all the folks we know and to find our thoughts filled with recollections of the good things we find in folks we meet and associate with all the time.

We ain't much givin' to makin' New Year's resolutions, but we feel so durned good and so filled with good will towards our neighbors and friends right now we're goin' to keep that same spirit alive all year long . . . anyway they ain't nobody we know of that we don't wish the best in the world to right now and we want to stay full of this same good will from now on.

They is a lot of folks who is better off today then they ever have bin before and it's a purty good idea for such folks to be kind of grateful for this situation . . . they is also some folks who is sick and miserable and unhappy and our deepest sympathy goes out to them . . . we hope in the New Year things will begin to look brighter and better for all of them.

But jist 'cause things look good right now ain't no sign we're jist goin' to sit back on our haunches and do nothing but congratulate ourselves . . . we learned a long time ago that more good things come to us when we're workin' to make 'em come true than when we jist sit back and wait.

So, as fer so many years past we're goin' to continue to look after our groves and crops the best we know how . . . and to continue to give 'em the proper amount of Lyons Fertilizers so thet we can harvest the Maximum Crops of Finest Quality.

Happy New Year again to you all!

# Florida Citrus Industry Meets With Great Loss

All Florida citrus interests deeply regret the death of Perry Murray who was killed in an automobile accident near his home at Frostproof. President of Florida Citrus Mutual, an extensive citrus grower and for many years a leader in all affairs of the industry, his untimely death entails a loss which will be felt in every branch of the industry.

---

Flowers are meaning more to Florida every year. Particularly when one considers the dollar value of flowers, flowering plants, nursery stock and foliage plants. Seven counties in the state, just to show how important the industry is, each sold more than a million dollar's worth of such products. Dade county was highest, with $3,741,000; Palm Beach second, $2,904,000; Orange, $2,543,000; Lee, $2,454,000; Manatee, $1,780,000; Volusia, $1,554,000; and Lake, $1,022,000.


## Classified Ads

SUPERIOR CITRUS TREES — Now accepting orders for Spring 1956 delivery. Sorry — we are sold out of Valencia and Hamlin, but have good supplies of other varieties. Call 2-7541 for quotations. Leaflet "Tips for Growers" mailed on request.

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OUTSTANDING DOGS
Bird dogs, Straight cooners, Fox and Deer hounds, Squirrel dogs. Trial allowed. Literature free.
Swannee River Kennels
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# Consumer's Preferences For Canned Grapefruit Juices

— By —
HUGH P. BELL

Here's a report on a consumer preference survey made in Indianapolis, Indiana, of interest to processors of canned grapefruit juices and to other trade groups who merchandise these products.

Marketing researchers of the Market Development Branch, Agricultural Marketing Service, recently conducted a study to determine consumers' preferences for canned grapefruit juices that varied in Brix-acid ratio, flavoring (sweetened versus unsweetened) and labeling.

They found that consumers prefer sweetened over unsweetened juices and labeled, whether "sweetened" or "unsweetened," over unlabeled juices.

The juices used in the test included unsweetened juices at Brix-acid levels of 7, 9, 11, and 13, with degrees Brix constant at 10. Sweetened juices had ratios of 9, 11, 13, and 15 with degrees Brix constant at approximately 12. The ratio ranges used in the tests were recommended by the Florida Citrus Commission and others in the citrus industry.

### Study Made In Indianapolis

The juices were tested in 640 randomly selected households by over 1,300 people (16 years old and over) in Indianapolis. One-half of the group received labeled juices and the other half unlabeled juices. Each juice was rated by from 140 to 190 persons.

The first week each household received one of the eight juices. One week later they received another juice. Each person rated a given juice on 3 consecutive days; a week later, another juice on 3 consecutive days. Juices were assigned in such a manner that every possible combination of any 2 juices occurred. The juices were kept under refrigeration and served chilled. Fresh cans were used on each of the three days.

Each person was asked to express his or her opinion about each juice by placing a check on a 10-point rating scale. The juice could be rated "very poor" through "excellent."

Consumers preferred sweetened juices over the unsweetened juices. Labeled juices, whether labeled "unsweetened" or "sweetened," was preferred over unlabeled juices. Within the unsweetened juices, the juice at 7 Brix-acid ratio was least preferred. There was no significant differences in the ratings of the sweetened juices at levels from 9 to 15.

The juices at 9 Brix-ratio represent the ratio at which the most preferred juices begin to be encountered. Among the unsweetened juices a shift from a 7 to 9 ratio brings the juices to a plateau of preference that extends through the 13 Brix-ratio. Among the sweetened juices the preference plateau extends from 9 to 15 Brix-acid ratio.

### Tested Willingness to Buy and Serve Juices

The pattern of the preference ratings, based on the taste tests, does not necessarily reflect upon the degree that people would actually like to have the product served in their


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homes. Nor does it necessarily reflect the homemaker's reactions toward buying the product, and whether or not their buying reactions reflect the pattern of their family's wishes. To investigate these relationships, the respondents', including homemakers, willingness to have each juice served in his home, was ascertained. Also, the homemakers' willingness to buy the respective juices was ascertained in a like manner.

The resulting preference pattern of the respondents' expression of willingness to serve and buy the respective juices for their homes was generally the same as the pattern based on the sweetened and unsweetened and labeled and unlabeled preference ratings.

The highest proportions of positive expressions of willingness to have the juices served were found among those respondents who had tested labeled juices and those who had tested sweetened juices. Within the sweetened and unsweetened juices, respectively, the pattern was similar to those based upon the preference ratings.

### Comparison With Other Citrus Products

In addition to determining the preference of the canned grapefruit juices, the relative preference position of the test juices was determined among competing citrus products. Each person was asked to compare each juice he had tested with frozen orange juice, frozen grapefruit juice, and canned orange juice.

Frozen orange juice was generally preferred over the unsweetened canned grapefruit juice tested. Unsweetened canned grapefruit juices with the exception of the juice at 7 Brix-acid ratio, were preferred over canned orange juice. Frozen grapefruit juice was the least preferred in each comparison.

On the other hand, when the sweetened grapefruit juices were compared with the other products, each of the test juices, with the exception of one, were ranked first. Frozen orange juice was second in preference, with canned orange juice third and frozen grapefruit fourth.


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ON MATTERS

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1 Year, $1.00 — 2 Years, $1.75 — 3 Years, $2.50



CITRUS GROWERS REPORT

# New Planting Method Is *Big Success*...

## KEEPS ROOTS MOIST!

**Terra-Lite, the miracle planting medium mixes with sandy soil; holds several times its weight in water; stops leaching; Low Cost; Cuts Water Bills.**

1 *No need to wait for rain.* Benefits both seedlings and resets.

2 *Mix Terra-Lite with soil* in planting hole. (As little as 10¢ a tree)

3 Terra-Lite holds and releases water and fertilizer as roots need them.

4 Water when planting; then once a month. (Photos; Jack Ross Grove)

## THIS GROWER DIDN'T LOSE A TREE WHEN HE PLANTED IN

# Terra-Lite®

## SOIL CONDITIONER

No need to wait for rain any more. Throughout these southern sandy soil regions, growers like Jack Ross (No. 4, above) report amazing results when trees are planted in a mixture of soil and Terra-Lite vermiculite. This low-cost mineral has an amazing capacity for *holding* water and fertilizer. Prevents wilt and dieback. And citrus *thrives*. Trees planted a year ago are six months ahead of their growth schedule. Costs as little as 10¢ a tree and you save ⅓ to ½ on your water bill; save labor, too. To bring groves into early bearing, to cut costs, and to insure vigorous trees, plant *anytime* in Terra-Lite. Get Terra-Lite from your seed jobber or fertilizer supplier today or mail coupon for free data.

TERRA-LITE DIVISION
SOUTHERN ZONOLITE COMPANY

FREE PLANTING INFORMATION

Terra-Lite Division
Southern Zonolite Company, Dept. CI-115
P. O. Box 8127, Station F, Atlanta, Georgia

*Gentlemen:* Please rush me free information about low cost Terra-Lite, the ideal soil conditioner, for citrus growers in sandy regions.

*Name*.....

*Address*.....

*City*.....*Zone*.....*State*.....

*If Our Wish*
*For You*
*Comes True*
*The Year*
*1956*
*will be the*
*finest*
*you have ever*
*known*

**Lyons Fertilizer Company**

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